

# Weathering the seasons of cancer survivorship: mind-body therapy use and reported reasons and outcomes by stages of cancer survivorship

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## Abstract

**Purpose** Mind-body therapies (MBTs), a subset of complementary and alternative medicine (CAM), are used by cancer survivors to manage symptoms related to their cancer experience. MBT use may differ by cancer survivorship stage (i.e., acute, short-term, long-term) because each stage presents varying intensities of medical activities, associated emotions, and treatment effects. We examined the relationship between MBT use and survivorship stage (acute <1 year; short-term 1 to 5 years; long-term >5 years since diagnosis) using the CAM supplement of the 2012 National Health Interview Survey. We also examined reported reasons for and outcomes of MBT use and frequency of MBT types.

**Methods** The sample included cancer survivors ( $N=3076$ ) and non-cancer controls ( $N=31,387$ ). Logistic regression tested the relationship of MBT use and survivorship stage. Weighted percentages were calculated by survivorship stage for reported reasons and outcomes of use and frequency of MBT types.

**Results** MBT use varied by cancer survivorship stage ( $p=0.02$ ): acute (8.3 %), short-term (15.4 %), long-term (11.7 %) survivorship and non-cancer controls (13.2 %). In the adjusted model, short-term survivors had 35 % greater odds of MBT use than did controls (95 % CI 1.00, 1.83). Reasons for and outcomes of MBT use varied among the survivorship stages, with more acute survivors reporting medical-related reasons and more short-term survivors reporting to manage symptoms.

**Conclusions** MBT may fulfill different symptom management needs at varying stages of survivorship. These findings can help inform supportive care services of survivors' use of MBT for symptom burden at each stage and the allocation of these services.

**Keywords** Cancer survivors · Cancer survivorship stage · Mind Body Therapy · Integrative health · National Health Interview Survey

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There are an estimated 14.5 million US cancer survivors, with 64 % diagnosed more than 5 years ago [1]. These numbers are projected to increase over the next decade by 22 % for survivors who will be less than 5 years post-diagnosis and 37 % for survivors more than 5 years post-diagnosis [2]. Importantly, at least 50 % of survivors experience lingering physical and mental effects of cancer and its treatments (i.e., long-term or late effects) beyond treatment completion [3–5]. These effects can include cognitive dysfunction, distress, pain, lymphedema, bone density loss, fatigue, sleep problems, reproductive/sexual dysfunction, cancer recurrence and new primary cancers, and the development of various chronic diseases [1, 4–6]. This symptom burden can be severe and disruptive to the survivor's quality of life (QOL), and, overall, they report worse physical and mental QOL and greater illness burden

(i.e., health utility, lost productivity, general health status, limitations in activities of daily living) than do non-cancer controls [7, 8].

Cancer survivors may turn to complementary and alternative medicine (CAM) therapies to help manage their symptoms [9] and to provide a sense of control over their health [10]. Mind-body therapies (MBT) are a subtype of CAM therapies that focus on an interaction between the mind (thoughts and emotions), body, and behavior and are used to alleviate physical and/or psychological symptoms, or to increase general wellbeing [11]. Examples include yoga, Tai Chi, Pilates, meditation, and guided imagery. Cancer survivors report using MBT to manage the effects of cancer and/or treatment including pain [12], stress [13–16], anxiety [15, 17], depression [15, 17], and fatigue [16, 18–20]. Moreover, substantial evidence supports their efficacy for enhancing coping ability [17] and QOL [13, 14, 20]. MBT are generally accepted by medical professionals as safe and efficacious non-pharmacological adjuncts to conventional cancer treatment for symptom management, with more cancer hospitals offering them as part of supportive care services [21].

It is possible that MBT use varies by whether one is managing the distress of a recent cancer diagnosis and its demanding treatments, transitioning into life after treatment with persisting symptoms, or the cancer experience is now a distal past event with few or no lingering symptoms [22, 23]. As first acknowledged by Mullan's classic "Seasons of Survival" [24, 25], survivorship stages (i.e., acute, transitional, and long-term survivorship) are characterized by varying intensities of medical activities, associated emotions, and treatment effects (long-term or late effects) [6, 7, 24–26]. As such, these stages may be associated with differing use of MBT to fulfill emotional or symptom management needs that characterize each survivorship stage.

For instance, the acute survivorship stage, which occurs during the initial cancer diagnosis and treatment, is characterized by intense fear and anxiety and taxing cancer treatments [24, 25]. While this period is emotionally charged, it can also serve as an impetus for engaging in self-care activities, such as MBT, to cope with extreme distress and for survivors to feel some control over their health [10, 27]. However, although they may desire to engage in such activities, it can also be difficult to do so while in the midst of a busy treatment schedule and/or adverse side effects (fatigue, pain, and nausea). The second stage, short-term survivorship, occurs during the transition from treatment completion and is characterized by watchful waiting for cancer recurrence or receiving maintenance treatment, balanced with an attempt to return to life as "normal" [6, 22, 24, 25]. This stage can also be highly distressing. First, there is often a loss of security felt under the watchful eye of the medical team during treatment and there may be difficulties proceeding with life as normal due to lingering treatment effects and newly emerging late effects

[6, 22, 25]. Moreover, once the shock of a cancer diagnosis and a busy treatment schedule has subsided, the experience of having been diagnosed with cancer may become more real to survivors. Not only can this lead to increased distress, but they may turn to making meaning of their cancer experience and developing causal attributions for why the cancer occurred and what behaviors may help prevent recurrence [26, 28]. Therefore, they may be more likely to engage in self-care activities, such as MBT, to reduce distress, manage symptoms, improve health for preventing a recurrence, and to feel more in control over their health [10]. Finally, long-term survivorship is characterized by a more complete resumption of normal life activities [24, 25]. Continual monitoring for cancer recurrence occurs to a lesser extent and psychological and physical effects may have diminished [3, 6, 24, 25, 29]. As the cancer experience becomes a more distal past event, long-term survivors may be less likely to engage in MBT considering that survivors' physical activity levels decrease between 5 and 10 years post-diagnosis [30] or they may be less likely to use MBT for cancer-related reasons if there are fewer persisting symptoms.

However, it is not known whether cancer survivors' MBT use varies among these survivorship stages. Prior studies have examined MBT use either in a single survivorship stage or cancer survivors in general (use not reported by survivorship stage). Those studies reported MBT use of 64 % among survivors within 2 months post-diagnosis [31], 52 % among survivors 10 to 24 months post-diagnosis [32], 27 % among survivors more than 5 years post-diagnosis [33], and 22 % in a general sample of cancer survivors (i.e., not examined by survivorship stage) [9]. However, these proportions may be higher than actual MBT use because religious activities (prayer) and psychosocial support services were included, which are considered more of conventional or standard of care practices rather than CAM modalities [34]. Therefore, the prevalence of MBT use among survivorship stages is not clear [9, 32–34].

In this study, we assessed MBT use as defined by the National Center Complementary and Integrative Health (NCCIH) [34]—procedures or techniques administered or taught by trained practitioners that consisted of relaxation skills or movement-based therapies. Our primary aim was to examine the relationship between cancer survivorship stage (i.e., acute survivorship <1 year post-diagnosis; short-term survivorship 1 to 5 years post-diagnosis; long-term survivorship  $\geq$  5 years post-diagnosis) and the reported use of MBT in a nationally representative sample of adults, using the CAM supplement of the 2012 National Health Interview Survey (NHIS). A secondary aim was to examine cancer survivors' reported reasons for and outcomes of their top used MBT and frequency of use for different types of MBT. Understanding how MBT use differs among survivorship stages can inform oncology supportive care services of MBT allocation and survivors' MBT use to manage symptom burden at each stage.

## Methods

### Participants

This study was based on the Adult CAM Supplement and the Sample Adult, Family, and Person Core components of the 2012 NHIS. The NHIS collects demographic and health-related information through in-person household interviews from a nationally representative sample of the US civilian, non-institutionalized, household population [35]. The National Center for Health Statistics (NCHS) conducts the NHIS Core annually; the CAM supplement is included every 5 years [35, 36]. In 2012, 108,131 individuals completed NHIS interviews with a 77.6 % household response rate [35]. Our study sample included 34,463 adults (ages  $\geq 18$ ) who had completed the CAM supplement. This secondary data analysis on de-identified, publicly available NHIS data was determined to be exempt by the UNC-CH Institutional Review Board.

### Measures

Our primary dependent variable was the use of MBT in the past 12 months, defined as having answered “yes” to using any of the following relaxation techniques or movement therapies, indicated by the NCCIH [34]: meditations, guided imagery, progressive relaxation, biofeedback, hypnosis, yoga, tai chi, qi gong, Trager, Pilates, Feldenkrais, and Alexander technique. Psychological therapy or support groups were not included because these conventional practices are not considered CAM [34]. To examine participants’ reported reasons for and outcomes of their MBT use, we examined those who indicated MBT was their top used CAM therapy to be consistent with NHIS questions that were directed toward the participant’s top therapy and to exclude other CAM modalities (e.g., natural products).

The primary independent variable was cancer survivorship stage. A cancer survivor was defined as a respondent who answered “yes” to the question: “have you ever been told by a doctor or other health professional that you had cancer or a malignancy of any kind?” This definition coincides with that used in cancer survivorship research to identify a survivor from the point of cancer diagnosis to end of life and does not distinguish whether the person has active disease or is in remission [37, 38]. Cancer survivors were asked a follow-up question regarding their age at diagnosis. As reported in analyses of the 2002 NHIS, when asked when their cancer first occurred, some participants appeared to have given the number of years since diagnosis rather than their age [8, 39]. We used the method described in greater detail by Yabroff and colleagues [8] to handle these discrepancies: for each cancer type, we compared the age at diagnosis to the delay-adjusted incidence rates provided by the Surveillance, Epidemiology

and End Results (SEER) Program [40]. If the rate was not available for a particular age, the value was categorized as “missing.” To examine the relationship of MBT use with cancer survivorship, we grouped the years since diagnosis into three stages of survivorship: (1) acute survivorship less than 1 year; (2) short-term survivorship 1 to 4.99 years; and (3) long-term survivorship 5 or more years [2, 6]. We viewed these stages as consistent with Mullan’s “seasons of survivorship”: acute survivorship, transitional survivorship, and long-term survivorship stages [22, 24, 25].

Sociodemographics included age (18–44, 45–64,  $\geq 65$ ), gender, race/ethnicity (Non-Hispanic white, Non-Hispanic black, Hispanic, Other—including Asians and American Indians), highest education level attained (no college, some college/Associate degree, and Bachelor degree or higher), household income (<200, 200–399,  $\geq 400$  % of federal poverty threshold), health insurance coverage (yes or no) [36, 41], and cancers grouped into main types as used in prior research [9] (breast, prostate, colorectal (colon, rectal), gynecological (cervical, ovarian, uterine), melanoma (excluding non-melanoma), and other cancers). The NHIS imputes missing values for race/ethnicity and oversamples Non-Hispanic blacks and Hispanics of any race [42]. We evaluated household income in relation to the 2011 poverty threshold using five NHIS-generated; multiply imputed datasets [42]. Health insurance coverage status consisted of health insurance in some capacity, including Indian Health Insurance.

### Statistical analysis

We identified the sociodemographic characteristics of acute, short-term, and long-term cancer survivors and those without a history of cancer in our sample by generating sub-population estimates using the corresponding sample adult weights provided by the NHIS. These weights take into account the multi-stage sampling, clustering, and stratification design of the NHIS [42]. We calculated the relative standard error of the weighted percentages to ensure stability of estimates with a relative standard error of less than 30 % used as the standard of reliability and precision [36].

We examined the bivariate relationships between the sociodemographic and health characteristics, and use of MBT in the past 12 months using Pearson’s Chi-square tests. We used logistic regression to examine the relationship of MBT use (dependent variable) and cancer survivorship stage (independent variable: <1 year since diagnosis, 1 to 5 years since diagnosis,  $\geq 5$  years since diagnosis). We started with a fully adjusted model then used a change-in-estimate approach to create a more parsimonious adjusted model using a criterion of a 10 % change in the odds ratio. We calculated weighted percentages for both reasons for and outcomes of MBT use (among those who reported MBT as their top therapy) and frequency of MBT types and used Pearson’s Chi-square tests

to compare by survivorship stages. STATA (v13, StataCorp LP, College Station, TX) was used for all statistical analyses, which includes a program for analysis of multiply imputed datasets. All statistical tests were two-sided with alpha set at 0.05.

## Results

### Characteristics of respondents

The sample included 3076 cancer survivors (acute  $n=552$ , short-term  $n=825$ , long-term  $n=1699$  survivorship stages)

and 31,387 non-cancer controls. Overall, cancer survivors tended to be older, Non-Hispanic white, and have health insurance compared with non-cancer controls (Table 1). Long-term cancer survivors were more likely to be older, female, and have a breast or gynecological cancer diagnosis than were acute and short-term cancer survivors (Table 1).

### MBT use in the past 12 months

Overall MBT use in the past 12 months was 13.1 % (Table 2). MBT use varied by cancer survivorship stage, with short-term cancer survivors reporting the greatest use (15.4 %), followed

**Table 1** Sociodemographic and health characteristics of study population by cancer survivorship stage

	No history of cancer		Acute survivorship		Short-term survivorship		Long-term survivorship	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	31,387	91.5	552	1.55	825	2.39	1699	4.53
Gender								
Female	17,350	51.4	297	49.9	472	55.2	1086	59.9
Age (years)								
18–44	14,960	50.6	65	10.9	99	14.2	156	9.9
45–64	10,742	34.6	196	42.9	323	40.9	567	35.0
$\geq 65$	5686	14.7	291	46.2	403	44.9	976	55.0
Ethnicity and race								
Non-Hispanic white	18,297	65.4	454	86.9	669	85.3	1377	85.8
Hispanic, any race	5672	15.8	29	3.19	52	5.2	98	5.1
Non-Hispanic black	4984	12.4	55	6.71	73	5.6	163	6.1
Other	2434	6.4	14	3.16	31	3.9	61	3.2
Highest education level attained								
No college	13,140	40.5	248	44.1	309	32.9	702	40.3
Some college/Associate degree	9633	31.4	156	29.5	265	34.6	509	31.3
Bachelor degree or higher	8477	28.2	144	26.4	249	32.4	484	28.3
Household income in relation to 2011 Federal Poverty Threshold <sup>a</sup>								
<200 %	73,482	43.1	1098	34.9	1470	31.1	3336	34.0
200–399 %	52,218	48.0	978	31.0	1362	28.8	3132	32.0
$\geq 400$ %	56,094	30.8	1074	34.1	1890	40.0	3294	33.0
Health insurance in some capacity, including IHS								
Yes	25,374	82.1	525	95.6	769	93.9	1590	94.3
Cancer types								
Breast	–	–	92	14.0	146	15.1	324	17.9
Prostate	–	–	58	11.6	116	14.4	187	11.5
Colorectal	–	–	34	5.21	69	6.80	96	4.90
Gynecological	–	–	42	5.60	69	7.62	296	15.4
Melanoma	–	–	65	12.6	64	8.34	114	7.76
Other Cancers	–	–	185	36.3	249	34.2	429	27.6

*Note.* Data source: NHIS, 2012. Estimates are based on household interviews of a sample of the civilian, non-institutionalized population. Percentages are age-adjusted using the projected 2010 US population as the standard population. Acute survivorship: <1 year post-diagnosis, short-term survivorship: 1 to 4.99 years post-diagnosis, long-term survivorship:  $\geq 5$  years post-diagnosis

<sup>a</sup> Household income was generated from five imputed datasets to account for missing values, income  $N$  is based on the five imputed dataset

by non-cancer controls (13.2 %), long-term survivors (11.7 %), and acute survivors (8.3 %;  $p < 0.02$ ). All sociodemographic characteristics were significantly related to MBT use (Table 2). Women, respondents younger than 65 years old, Non-Hispanic white or Other race, and individuals with health insurance were more likely to report MBT use.

**Table 2** Bivariate relationships between use of mind-body therapies<sup>a</sup> in past 12 months and sociodemographic and health characteristics among US adults

	Number	Percent	95 % CI
Overall use	4310	13.1	12.6, 13.7
Cancer survivorship status			
No history of cancer	3940	13.2	12.6, 13.8
Acute survivorship	46	8.3	5.7, 11.9
Short-term survivorship	107	15.4	12.1, 19.5
Long-term survivorship	212	11.7	10.0, 13.7
Gender			
Male	1245	8.4	7.8, 9.1
Female	3065	17.5	16.7, 18.3
Age (years)			
18–44	2400	15.8	15.0, 16.7
45–64	1436	12.7	11.9, 13.5
≥65	474	6.7	5.9, 7.5
Ethnicity and race			
Non-Hispanic white	3056	14.9	14.2, 15.6
Non-Hispanic black	423	8.4	7.4, 9.5
Hispanic, any race	425	7.3	6.5, 8.23
Other	406	16.5	14.5, 18.6
Highest education level attained			
No college	659	5.23	4.7, 5.8
Some college/Associate degree	1477	14.0	13.1, 14.9
Bachelor degree or higher	2169	23.4	22.1, 24.5
Household income in relation to 2011 Federal Poverty Threshold <sup>b</sup>			
<200 %	7356	33.4	32.6, 34.2
200–399 %	6768	29.7	29.1, 30.4
≥400 %	11,622	36.8	35.9, 37.7
Health insurance in some capacity, including IHS			
Yes	3707	13.7	13.1, 14.3

*Note.* Data source: NHIS, 2012. Estimates are based on household interviews of a sample of the civilian, non-institutionalized population. Percentages are age-adjusted using the projected 2010 US population as the standard population. Acute survivorship: <1 year post-diagnosis, short-term survivorship: 1 to 4.99 years post-diagnosis, long-term survivorship: ≥ 5 years post-diagnosis

<sup>a</sup> Mind-body therapies includes biofeedback, hypnosis, yoga, tai chi, qi gong, Trager, Pilates, Feldenkrais, Alexander technique, mindfulness meditation, mantra meditation, spiritual meditation, guided imagery, and progressive relaxation

<sup>b</sup> Household income was generated from five imputed datasets to account for missing values. The income *N* is based on these five imputed datasets

In the logistic regression model adjusted for gender, age, race/ethnicity, and income, more short-term cancer survivors reported MBT use in the past 12 months than those with no history of cancer (OR=1.35, 95 % CI 1.00, 1.82), whereas acute and long-term survivorship stages did not significantly differ from controls (Table 3).

### Reasons for and outcomes of MBT use and frequency of MBT types

Among respondents who reported MBT as their top CAM therapy ( $N = 2242$ ), more acute survivors reported using MBT to treat a medical condition (46 % vs. 30 % short-term, 33 % long-term, and 22 % controls,  $p = .02$ , Table 4) and to improve immune function (56 % vs. 28 % short-term, 33 % long-term, and 29 % controls,  $p = .09$ ). On the other hand, more short-term survivors reported using MBT to improve memory (56 % vs. 43 % acute, 43 % long-term, and 35 % controls,  $p < .047$ ). Although the most frequently reported reason for MBT use across survivorship stages was for general wellness and disease prevention, this did not significantly differ among stages (80 % acute, 88 % short-term, 70 % long-term,  $p = .19$ ).

For outcomes of MBT use, more acute survivors reported that use of MBT helped them to cope better with health problems (80 % vs. 57 % short-term, 56 % long-term, and 43 % controls,  $p < .0001$ , Table 4) and improve sleep (82 % vs. 53 % short-term, 52 % long-term, and 62 % controls,  $p = .08$ ). The most frequently reported MBT outcome across survivorship stages, which did not differ among stages, was that it reduced stress or contributed to relaxation (86 % acute, 88 % short-term, 85 % long-term,  $p = .97$ ).

Next, we examined the use of different MBT types in the past 12 months (Table 5). More short-term survivors (9.9 %)

**Table 3** Use of mind-body therapies in past 12 months among US adults by cancer survivorship stage

	Unadjusted model		Adjusted model	
	OR	95 % CI	OR	95 % CI
No History of cancer (referent)	1.00		1.00	
Acute survivorship	0.70	0.45, 1.09	0.73	0.48, 1.11
Short-term survivorship	1.27	0.92, 1.75	1.35	1.00, 1.82
Long-term survivorship	0.98	0.78, 1.24	1.08	0.90, 1.31

*Note.* Data source: NHIS, 2012. Estimates are based on household interviews of a sample of the civilian, non-institutionalized population. Odds ratios are age adjusted using the projected 2010 US population as the standard population. Acute survivorship: <1 year post-diagnosis, short-term survivorship: 1 to 4.99 years post-diagnosis, long-term survivorship: ≥ 5 years post-diagnosis. Final model is adjusted for race/ethnicity, gender, income, and age

**Table 4** Reasons and outcomes for mind-body therapy use reported as top therapy

	No history of cancer		Acute survivorship		Short-term survivorship		Long-term survivorship		<i>p</i> value
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
Total sample of MBT Users <sup>a</sup>	2062	92.8	28	1.1	48	2.3	104	3.8	
Reasons for MBT use:									
For general wellness/or disease prevention	1569	76	21	80	40	88	72	70	.19
To improve energy	1342	64.6	21	61.3	25	48.4	55	55.7	.17
For immune function	631	29	15	56	15	28	36	33	.09
To improve memory	749	35	13	43.3	22	56.2	42	43	.047
To treat a medical condition	452	22.3	10	46.3	17	29.8	37	33.1	.02
MBT led to these outcomes:									
Gave sense of control over one's health	1231	60	17	64	28	49	57	52	.37
Reduced stress or for relaxation	1771	87	24	86	41	88	92	85	.97
Slept better	842	62	15	82.1	23	53.4	43	52.2	.08
Felt emotionally better	1512	74	22	82.9	34	66.2	77	70.6	.54
Coped better with health problems	920	42.9	20	80.5	26	57.4	57	55.9	.0001
Improved overall health, felt better	1665	81	21	81	39	77.4	76	71.5	.31

*Note.* Acute survivorship: <1 year post-diagnosis, short-term survivorship: 1 to 4.99 years post-diagnosis, long-term survivorship:  $\geq 5$  years post-diagnosis. *p* values are based on two-sided Chi-square analyses

<sup>a</sup> The sample for this table includes data for survey respondents who stated that MBT was their top therapy and they reported on reasons for MBT use and its outcomes. Additionally, respondents could answer more than one reason for MBT use and outcome

and controls (9.4 %) reported using yoga than acute (4.3 %) and long-term survivors (7.4 %,  $p = .005$ ). Additionally, more short-term survivors (3.1 %) and controls (2.1 %) reported use of Pilates than did acute (1.6 %) and long-term survivors

(1.2 %,  $p = .05$ ). Finally, reported use of guided imagery was greater across the three survivorship stages (acute 3.0 %, short-term 2.3 %, long-term 2.6 %) than that reported by controls (1.6 %,  $p = .03$ ).

**Table 5** Types of mind-body therapies used in past 12 months among US adults by cancer survivorship status

	No history of cancer		Acute survivorship		Short-term survivorship		Long-term survivorship		<i>p</i> value
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
Overall use	3940	13.2	46	8.2	107	15.4	212	11.7	.02
Mindfulness meditation	579	1.9	12	2.4	17	2.6	36	1.8	.66
Mantra meditation	502	1.6	12	2.5	22	2.7	31	1.4	.13
Spiritual meditation	924	3.0	21	3.6	30	4.5	65	3.3	.32
Progressive relaxation	650	2.0	16	3.2	26	2.9	47	2.7	.14
Guided imagery	496	1.6	13	3.0	21	2.3	47	2.6	.03
Biofeedback	95	0.3	2	0.2	4	0.7	6	0.3	.30
Hypnosis	81	0.26	0	0.0	2	0.4	7	0.36	.68
Yoga	2753	9.4	25	4.3	71	9.9	122	7.4	.005
Tai Chi	378	1.1	10	1.6	13	1.9	29	1.2	.21
Qigong	134	0.35	2	0.2	3	0.25	11	0.5	.51
Trager	10	0.03	1	0.02	1	0.03	0	0	.71
Pilates	593	2.1	8	1.6	23	3.1	24	1.2	.05
Feldenkrais	15	0.04	2	0.5	2	0.03	1	0.01	<.001
Alexander technique	29	0.1	1	0.3	1	0.02	0	0	.31

*Note.* Acute survivorship: <1 year post-diagnosis, short-term survivorship: 1 to 4.99 years post-diagnosis, long-term survivorship:  $\geq 5$  years post-diagnosis. The sample for this table includes data for individuals who reported MBT use in past 12 months and responded to items. *p* values are based on two-sided Chi-square analyses.

## Discussion

Mullan's classic "Seasons of Survival" [24, 25] first acknowledged that "seasons" or stages of survivorship are characterized by varying intensities of medical activities, associated emotions, and management of new or lingering treatment effects [6, 7, 24–26]. Cancer survivors report using CAM therapies, including MBT, to help manage symptom burden [9, 39]. However, prior studies have not examined MBT use by survivorship stages (e.g., one stage or across stages was examined) [31–33] or have included conventional approaches (religious activities and/or psychological support services) in their overall assessment of MBT use [9, 32, 39]. Therefore, overall MBT use among cancer survivorship stages was unclear. Using the large population-based sample of the 2012 NHIS CAM supplement, we examined whether MBT use and reported reasons for and outcomes of this use differed among survivorship stages.

Overall, we found that more short-term cancer survivors reported MBT use, followed by non-cancer controls, long-term survivors, and then acute survivors reporting the least amount of use. Furthermore, short-term survivors had 35 % greater odds of MBT use than did non-cancer controls. Several factors may account for why more short-term survivors reported MBT use than did acute and long-term survivors. The short-term survivorship stage is a transitional stage that bridges treatment completion with the return to life as "usual." However, although intense treatment regimens may be completed (i.e., exception of maintenance therapies), the desire to move on with life is often juxtaposed by cancer-related distress (e.g., fear of recurrence, anxiety) and lingering or new physical symptoms [6, 22, 25]. Likewise, short-term survivors' most frequently reported reasons of MBT use were for general wellness or disease prevention and, in comparison to acute and long-term, they were more likely to report using MBT to improve memory. Additionally, their most frequently reported outcomes of MBT use were that it reduced stress and improved overall health or felt better. Finally, their most frequently reported MBT types consisted of relaxation-based activities (i.e., meditations, progressive relaxation), although similar to the other stages, but they also reported using more movement-based MBT types (yoga, Pilates) than did the other survivorship stages. Consistent with the challenges characterizing this transitional period, this suggests that MBT may be fulfilling needs to address distress (e.g., fear of cancer recurrence [43]), desires to improve health (i.e., engagement in more physically active MBTs, such as Pilates and yoga), and to manage treatment-related effects (i.e., cognitive impairments [44]).

On the other hand, although fewer acute cancer survivors reported MBT use, they reported more medical-based reasons for their use (i.e., to treat medical condition, improve immune function) and MBT outcomes relevant to undergoing

treatment (i.e., it helped to sleep better, cope better with health problems) than did short-term and long-term survivors. It also appeared that they reported more MBT types consistent with coping during treatment (i.e., meditation, progressive relaxation, guided imagery). During the acute stage, survivors may feel too overwhelmed with treatment demands (i.e., time, fatigue, pain, nausea) to utilize MBT, but recognize their potential benefits for coping with treatment demands.

Finally, we found that long-term survivors reported MBT use that was generally between acute and short-term survivors' reported use. In this stage, their most frequently reported MBT reason was for general wellness/disease prevention (although, to a lesser extent than the other survivorship stages). The most frequently reported outcomes of MBT use were reduced stress, overall health improvement, and they felt better emotionally. This seems to point to more general reasons and outcomes of MBT use, rather than reasons or outcomes indicating medical (i.e., immune function) or symptom-specific needs (i.e., improve memory). Their reported MBT use consisted mainly of yoga (although, to a lesser extent than short-term survivors), fewer reports of some relaxation-based activities (i.e., meditations), and use of guided imagery and progressive relaxation comparable to the other stages. Overall, this suggests that long-term survivors may have been using MBT less to manage needs associated with undergoing treatment or cancer-related symptoms. Instead, they may have been using MBT for general health and wellbeing needs, consistent with research that long-term survivors experience improvements in the cancer burden [45].

These findings should be interpreted within the context of a few limitations. First, the NHIS relies on self-reported measures that are not confirmed by medical chart review, which may have led to under-reporting of cancer diagnoses and incorrect age at diagnosis. Second, our findings for survivors' reported reasons for and outcomes of MBT and MBT types are limited to the small number of survivors who reported MBT as their top CAM therapy or responded to that portion of the survey. Third, we were unable to determine the proportion of survivors in each stage that had an established MBT practice prior to cancer diagnosis as they may have been more likely to continue this practice throughout survivorship. Finally, the NHIS is limited to individuals residing in households and who are well enough to participate.

## Conclusion

In summary, these results indicate that cancer survivors' use of MBT and their reported reasons and outcomes vary by cancer survivorship stage, indicating MBT fulfills different needs associated with each stage. Future research should determine

barriers and facilitators of MBT use among these survivorship stages, particularly regarding acute survivors' less use of MBT. It may be that as more cancer hospitals implement MBT as part of their oncology supportive services, survivors in the acute survivorship stage are more likely to use and benefit from these. Understanding how the use of MBT differs among survivorship stages can be used to inform the allocation of these services in oncology supportive care as noninvasive therapies to help survivors manage their cancer symptom burden.

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**Compliance with ethical standards**

**Conflicts of interest** The authors have no actual or potential conflicts of interest with the organization that sponsored the research (National Center for Complementary and Integrative Health). The authors have full control of all primary data and agree to allow the journal to review their data if requested.

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